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MATHEMATICS**0580/42**

Paper 4 (Extended)

October/November 2024**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.



1 (a) Anvi buys a new car.

- (i) The price of the car is \$28 240.
She is given a 7.5% discount.

Calculate the amount she pays.

\$ [2]

- (ii) The fuel tank in the new car has a capacity of 45 litres.
This is 72% of the capacity of the fuel tank in her old car.

Calculate the capacity of the fuel tank in her old car.

..... litres [2]

- (b) Aadi buys a new car costing \$28 000.
He pays for the car using a finance plan.
The finance plan is

- a deposit
- 47 equal monthly payments of \$330
- a final payment of \$11 490.

Using this finance plan, Aadi pays a total of \$31 900 for the car.

Calculate the deposit paid as a percentage of \$28 000.

..... % [4]





- (c) A car travels 64 km and uses 2.5 litres of fuel.
It then travels 128 km and uses 6 litres of fuel.

Calculate the rate at which the car uses fuel during the whole journey.
Give your answer in litres per 100 km.

..... litres per 100 km [2]

- (d) At the start of 2021 the value of a car was \$46 500.
At the end of 2021 the value of the car was 20% less.
At the end of 2022 the value of the car was 15% less than its value at the end of 2021.

Calculate the value of the car at the end of 2022.

\$ [2]

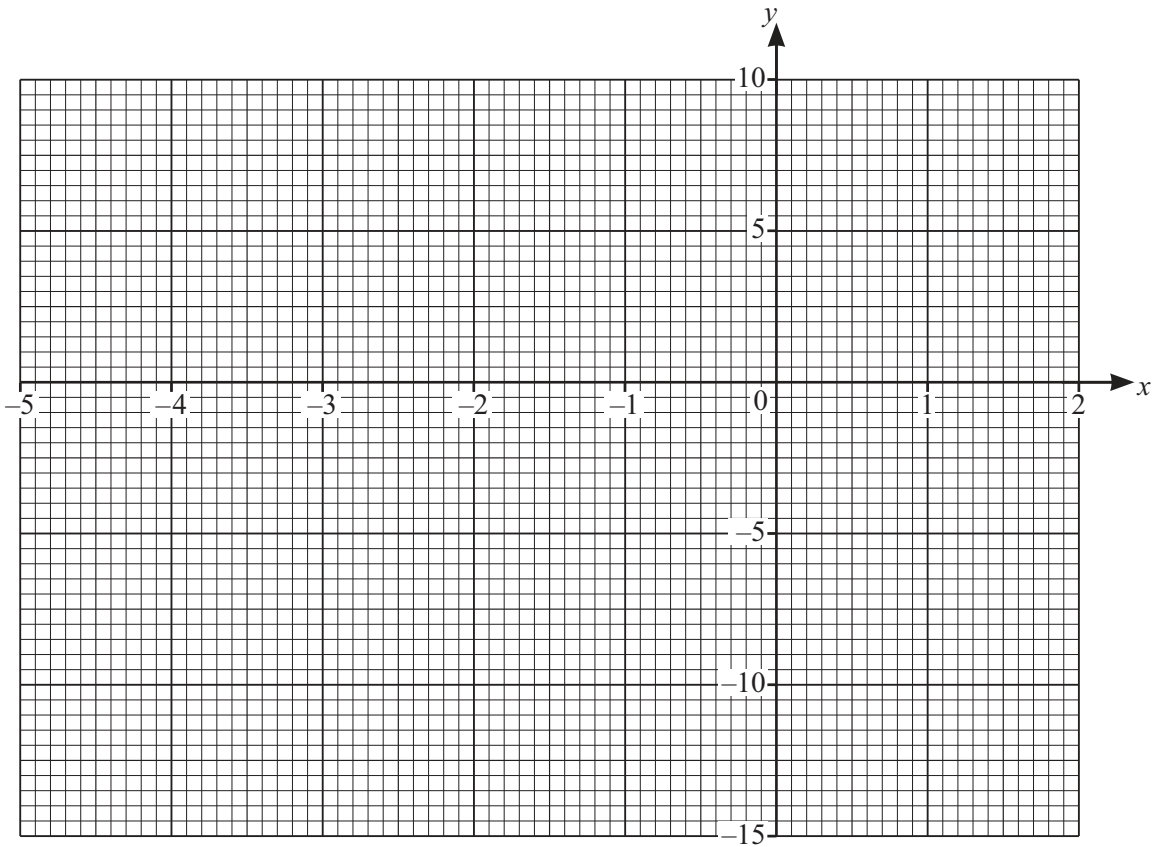




2 The table shows some values for $y = x^3 + 4x^2 - 4$.

x	-4.5	-4	-3	-2	-1	0	1	1.5
y	-14.1		5	4		-4	1	8.4

- (a) Complete the table. [2]
- (b) On the grid, draw the graph of $y = x^3 + 4x^2 - 4$ for $-4.5 \leq x \leq 1.5$.



- (c) (i) Draw the tangent to the graph at the point (1, 1). [1]
- (ii) Use your tangent to estimate the gradient of the curve at the point (1, 1).

..... [2]





(d) By drawing a suitable straight line on the grid, solve the equation $x^3 + 4x^2 - x - 6 = 0$.

$x = \dots\dots\dots$ Or $x = \dots\dots\dots$ Or $x = \dots\dots\dots$ [4]





3 (a) Simplify.

(i) $3m - 5n - 4m + 8n$

..... [2]

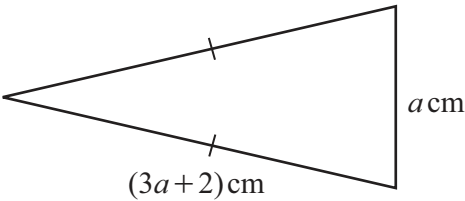
(ii) $(3a^2c^3)^4$

..... [2]

(iii) $\frac{4x}{5} - \frac{3x}{10} + \frac{2x}{15}$

..... [2]

(b) This isosceles triangle has a perimeter of 35.5 cm.



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Find the value of a .

$a =$ [3]





- (c) Using the quadratic formula, solve $5x^2 - 4x - 3 = 0$.
You must show all your working.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (d) Solve these simultaneous equations.

$$\begin{aligned} y &= x^2 - 4x + 5 \\ y &= 2x - 3 \end{aligned}$$

You must show all your working.

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [5]$$



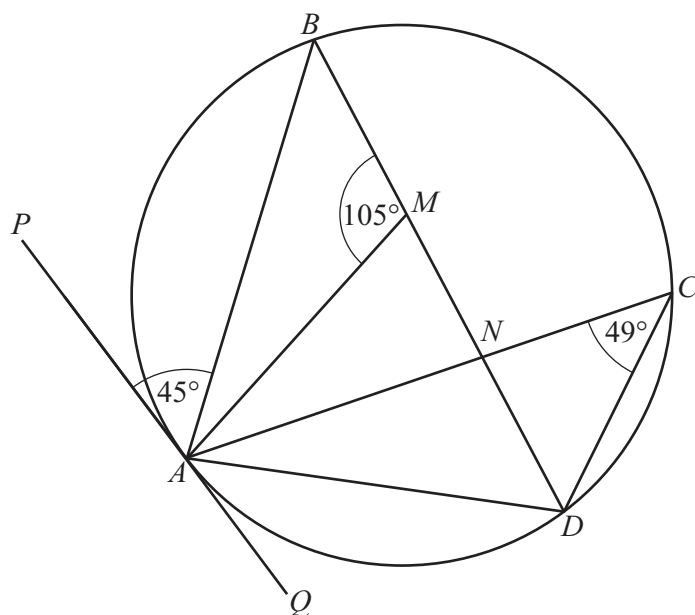


- 4 (a) The angles of a quadrilateral are w° , x° , y° and z° .
The ratio $w : (x + y + z) = 3 : 5$.

Find the value of w .

$w = \dots\dots\dots$ [2]

(b)



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A, B, C and D are points on a circle.
 PQ is the tangent to the circle at A .
 $BMND$ is a straight line.
Angle $ACD = 49^\circ$, angle $AMB = 105^\circ$ and angle $PAB = 45^\circ$.

- (i) Find angle BAM .

Angle $BAM = \dots\dots\dots$ [2]

- (ii) (a) Find angle BAD .

Angle $BAD = \dots\dots\dots$ [2]

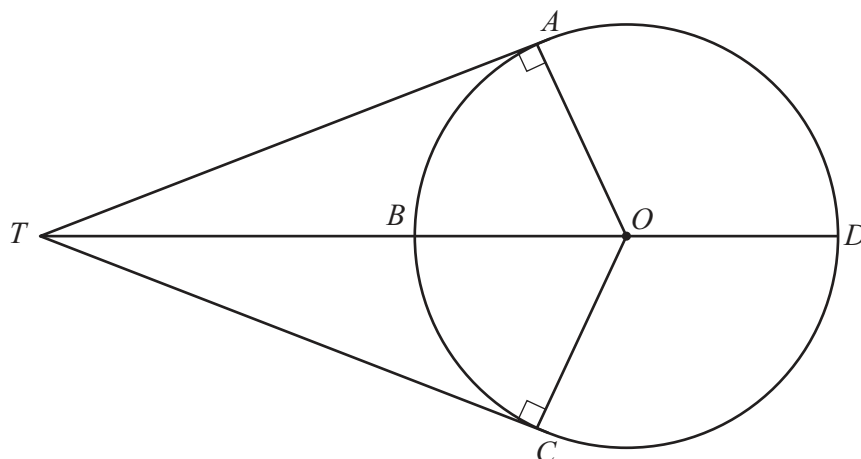
- (b) Give a geometrical reason why BD is **not** the diameter of the circle.

$\dots\dots\dots$
 $\dots\dots\dots$ [1]





(c)



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A, B, C and D are points on a circle, centre O .
 TA and TC are tangents to the circle.
 $OA = 6.75$ cm and $OT = 11.5$ cm.

(i) Show that angle $AOC = 108.12^\circ$, correct to 2 decimal places.

[3]

(ii) Calculate the length of the **minor** arc ABC .

..... cm [2]

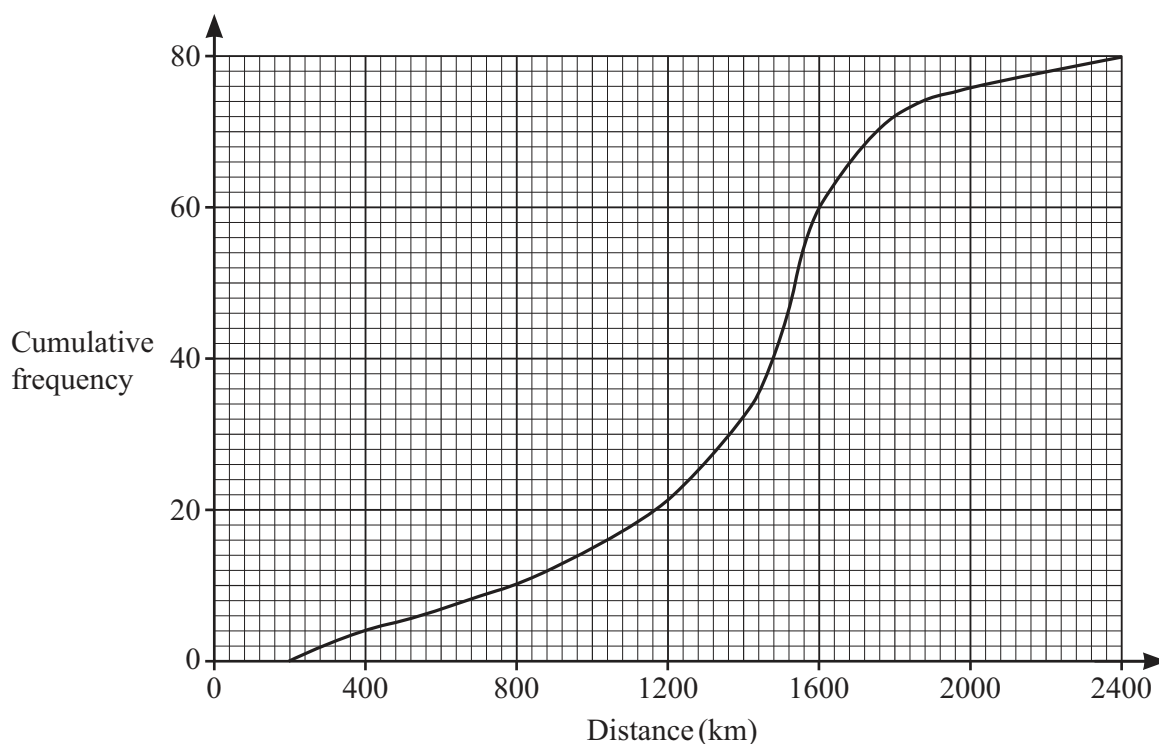
(iii) Calculate the area of the **major** sector $OCDA$.

..... cm^2 [3]





- 5 (a) The cumulative frequency diagram shows information about the distance travelled by each of 80 motorists in a month.



- (i) Use the cumulative frequency diagram to find an estimate for

(a) the median

..... km [1]

(b) the interquartile range

..... km [2]

- (ii) One of these motorists is picked at random.

Find the probability that this motorist travels more than 1800 km.

..... [2]

- (b) The distance around a racing track is 5.104 km.

The time taken by a car to complete one lap of the track is 1 min 18 s.

Calculate the average speed of the car.

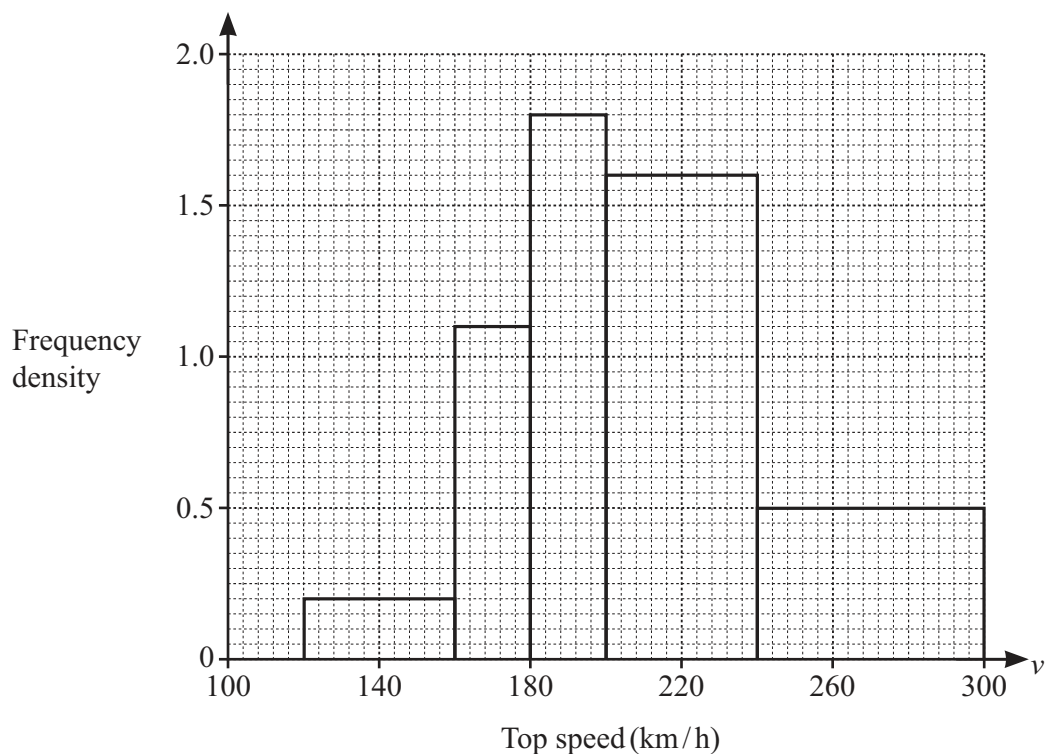
Give your answer in km/h.

..... km/h [3]





- (c) The top speed, v km/h, of each of 160 cars is recorded.
The histogram shows this information.



- (i) Show that there are 8 cars with a top speed in the interval $120 < v \leq 160$.

[1]

- (ii) Calculate an estimate of the mean top speed.
You must show all your working.

..... km/h [6]





6 (a) Work out $2\begin{pmatrix} 3 \\ -5 \end{pmatrix} - \begin{pmatrix} 2 \\ -7 \end{pmatrix}$.

$\begin{pmatrix} \\ \end{pmatrix}$ [2]

(b) $\overrightarrow{MN} = \begin{pmatrix} -6 \\ 4 \end{pmatrix}$.

(i) M is the point $(2, -5)$.

Find the coordinates of N .

$(\dots\dots\dots , \dots\dots\dots)$ [1]

(ii) Find $|\overrightarrow{MN}|$.

$\dots\dots\dots$ [2]

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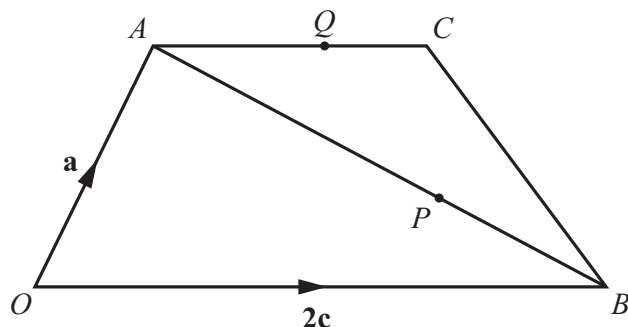
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(c)



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$OACB$ is a trapezium with $OB = 2AC$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = 2\mathbf{c}$.

$AP : PB = 4 : 1$ and $AQ = \frac{4}{5}AC$.

- (i) Write each of the following in terms of $\mathbf{a}$ and $\mathbf{c}$.
Give each answer in its simplest form.

(a) $\overrightarrow{AB}$

..... [1]

(b) $\overrightarrow{CB}$

..... [1]

(c) $\overrightarrow{OP}$

..... [2]

(d) $\overrightarrow{QP}$

..... [2]

- (ii) Use your answers to make **two** statements about the relationship between lines QP and CB .

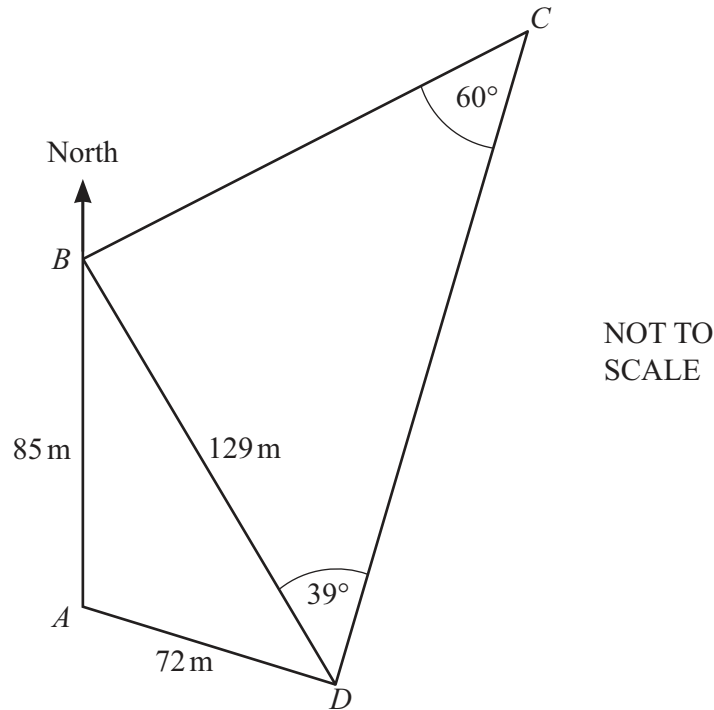
.....

..... [2]





7 (a)



The diagram shows a field, $ABCD$ with B north of A .
 BD is a path across the field.
 $AB = 85\text{ m}$, $AD = 72\text{ m}$, $BD = 129\text{ m}$, angle $BDC = 39^\circ$ and angle $BCD = 60^\circ$.

(i) Show that angle $CBD = 81^\circ$.

[1]

(ii) Calculate CD .

..... m [3]

(iii) Show that angle $ABD = 31.6^\circ$, correct to 1 decimal place.

[4]





(iv) Find the shortest distance from A to BD .

..... m [3]

(v) Find the bearing of B from C .

..... [2]

(vi) Trees are planted in the field.
The number of trees planted is 1100 per hectare.

Calculate the total number of trees planted in the field.
[1 hectare = 10 000 m²]

..... [4]

(b) A rectangle has an area of 9400 cm², correct to the nearest 100 cm².
The length of the rectangle is 80 cm, correct to the nearest 10 cm.

Calculate the upper bound of the width of the rectangle.

..... cm [3]





- 8 (a) A bag contains 24 coloured beads.
Some are red, some are blue and 10 are yellow.
One bead is picked at random from the bag.

Find the probability that

- (i) the bead is yellow

..... [1]

- (ii) the bead is not yellow.

..... [1]

- (b) Another bag contains 5 green marbles, 6 white marbles and 4 black marbles.
Meera picks 2 marbles at random from the bag, without replacement.

Find the probability that

- (i) the first marble is black and the second marble is white

..... [2]

- (ii) both marbles have different colours.

..... [4]

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9 $f(x) = 2x - 5$ $g(x) = x^2 - 2x$

(a) Find

(i) $f(7)$

..... [1]

(ii) $gf(7)$

..... [1]

(iii) $f^{-1}(x)$.

$f^{-1}(x) =$ [2]

(b) Find $gf(x) - 3g(x)$.

Give your answer in the form $ax^2 + bx + c$.

..... [4]





10 A curve has the equation $y = x^3 - 9x^2 - 48x$.

(a) Differentiate $x^3 - 9x^2 - 48x$.

..... [2]

(b) Find the coordinates of the turning points of the graph of $y = x^3 - 9x^2 - 48x$.
You must show all your working.

(..... ,) and (..... ,)
[4]

(c) Determine whether each of the turning points is a maximum or a minimum.
Give reasons for your answers.

[3]





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